920476-95824

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of	:	Naden, James et al.
Serial No.	:	10/814,897
Filed	:	March 31, 2004
For	:	Multi-hop Load Balancing
Examiner	:	Wendell, Andrew
Art Unit	:	2618
Customer number	:	23644

BRIEF ON APPEAL

Honorable Director of Patents and Trademarks
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir,

This appeal is from the Examiner's final rejection of June 13, 2006 and the advisory action of August 25, 2006 in which all pending claims, that is claims 1-40, were rejected. An appropriate response was e-filed on August 10, 2006 and a timely Notice of Appeal was submitted on September 11, 2006 with the required fee of $500.

This brief fee of $500 should be deducted from Deposit Account No. 12-0913.

(i) Real Party in Interest

This application is assigned to Nortel Networks Limited. The assignments are recorded at Reel 015548/0249.

(ii) Related Appeals and Interferences

There are no related appeals or interferences or judicial proceedings.

(iii) Status of Claims

This application was filed with claims 1 through 40, which remain unamended. Claims 1-40 have been finally rejected by the Examiner. The rejection of claims 1-40 in the office action of June 13, 2006 is appealed. Claims 1-40 as originally filed are set forth in the Claims Appendix.

(iv) Status of Amendments

No amendments have been made to the claims following the final rejection. A response was filed on September 11, 2006, and was entered.

(v) Summary of Invention

The present invention relates to providing communications links between a base station and terminals in a wireless communications system. A base station defines a plurality of beams, with each beam having a limited amount of resources. A base station can attempt to serve a new terminal via a direct communication link using the resources of a first beam of the base station. If a direct link cannot be supported, the base station serves the new terminal using a multi-hop path via a relay equipment. The resources of a second beam of the base station are used to provide a link between the base station and the relay equipment. A further link is established between the relay equipment and the new terminal. In this way, the load on the base

station is shared among several beams and a communication link can be provided to a new terminal even when the first beam of the base station has insufficient resources to support a direct link with the new terminal.

Independent claim 1:

This claim summarizes the invention conveniently and specifies a control entity for a wireless communications system which comprises a plurality of base stations, each base station defining a plurality of beams which each have an amount of resources for supporting communication links with terminals located in the beams, and a relaying equipment, wherein the control entity is arranged to determine if a direct communication link can be supported between a new terminal and a base station using a first beam and, if the direct communication link cannot be supported, to invoke use of the relaying equipment to provide a first communication link between a base station and the relaying equipment using the resources of a second beam and a second communication link between the relaying equipment and the terminal whereby to provide a multi-hop path between the base station and the terminal.

As described at page 1 line 21 to page 2 line 13 of the application, a significant problem in wireless systems is matching load on each beam with the available resources that have been allocated to that beam. The scheme according to claim 1 allows a communication link to be established with a new terminal even when the first beam is fully loaded. Thus, a higher number of terminals can be served by the base station compared to a conventional system. Figure 5 of the present application shows how a terminal T5 positioned within an overloaded beam 60 can be served by a relay R3 positioned in a more lightly loaded beam 63. The second beam required by claim 1 can be a neighbouring beam to the first beam or, as shown in Figure 5, a beam which is some way from the first beam. In Figure 5 there are two intermediate beams 61, 62 positioned between the beam 63 which provides the link between the base station and the relay R3 and the beam 60 in which the terminal T5 is positioned.

Independent claim 20:

This claim relates to a base station which includes the control entity of claim 1 and so the discussion of claim 1 applies here.

Independent claim 21:

This claim relates to a base station controller which includes the control entity of claim 1 and so the discussion of claim 1 applies here.

Independent claim 22:

This claim relates to a terminal which includes the control entity of claim 1 and so the discussion of claim 1 applies here.

Independent claim 23:

This claim is to a method which has corresponding distinctive features as claim 1 and so the discussion of claim 1 applies here.

Independent claim 39:

This claim is to a computer program product which has corresponding distinctive features as claim 1 and so the discussion of claim 1 applies here.

Independent claim 40:

This claim has corresponding distinctive features as claim 1 and so the discussion of claim 1 applies here.

vi) Grounds of Rejection to be Reviewed on Appeal

There are two basic grounds of rejection to be reviewed in this Appeal:

(1) Claims 1-3, 6, 10-12, 15-25, 27, 31-33, and 36-40 have been rejected by the Examiner under 35 U.S.C. §102(b) as being anticipated by Fette (US 5,612,948).

(2) Claims 4, 5, 13, 14, 26, 28-30, 34 and 35 have been rejected by the Examiner under 35 U.S.C. §103(a) as being unpatentable over Fette in view of one or more of Lamoureux (US 6,330,458), Chen (US 2003/0195017), Brody (US 4,670,899), Cheng (US 2005/0143084), Wiedeman (US 6,775,251) and Lovinggood (US 6,934,511).

(vii) Argument

Ground (1)

Claims 1-3, 6, 10-12, 15-25, 27, 31-33, and 36-40 have been rejected for anticipation by Fette and all remaining claims are rejected for obviousness over Fette in view of at least one other reference. All rejections are governed by a question of interpretation of certain claim features and whether Fette shows such claim features.

In the previous responses, Applicants have reasoned that Fette fails to teach all of the features present in the final clause of claim 1 namely,

> *"if the direct communication link cannot be supported, to invoke use of the relaying equipment to provide a first communication link between a base station and the relaying equipment using the resources of a second beam and a second communication link between the relaying equipment and the terminal whereby to provide a multi-hop path between the base station and the terminal."*

Of particular issue, is the feature of "a first communication link between a base station and the relaying equipment using the resources of a second beam"

In the Actions of February 21, 2006 and June 13, 2006 Examiner appeared to overlook, or misconstrue, this feature. In analyzing the features of claim 1, Examiner quoted support for this feature at col. 3 lines 41-57 and col.4 lines 22-34 of Fette.

Neither passage mentions the use of different beams in the manner required by claim 1.

Fette describes a cellular network which addresses the problem of providing coverage to subscribers. Fette notes (see col.1 lines 41-48) that obstructions such as hills and buildings can prevent a direct line-of-sight path with a subscriber at high frequencies. Fette addresses this problem by allowing a base node (12) to communicate with a subscriber node (16) via a subscriber node (16') which acts as a repeater. In Fette, a base node transmits a signal (see Fig.4) divided into frames. Data slots 48 within each frame are allocated to provide links to subscriber nodes 16. As described at col.5 lines 1-13, indirect communication with a subscriber node (i.e. communication via a repeating subscriber node 16') requires more slots of a frame compared to direct communication with a subscriber node since some slots are required for communication between the base node and a repeating subscriber node and further slots are needed for repeating the communication between the repeating subscriber node and subscriber node. This passage of Fette clearly shows that the same resources (time slots 48) of the same beam defined by the base node are used irrespective of whether a base node communicates directly, or indirectly, with a subscriber node.

It can be seen that this contrasts with what is required by claim 1. In claim 1 an attempt is made to use a first beam to provide a direct communication link with a terminal and, failing that, the resources of a second beam are used to provide a first 'hop' of a multi-path link with the terminal, with the first hop extending between the base station and a relay equipment.

In the Advisory Action of August 25, 2006 Examiner, for the first time, draws attention to a passage at col.3 lines 62-64 of Fette. However, Applicants have already discussed this passage of Fette in their first response. The passage at col.3 lines 62-64 of Fette simply states how "network 10 may utilize spatial diversity

obtained through diverse antenna beams projected in different directions." Fette gives no further instruction of how the "antenna beams projected in different directions" would be used. The Examiner is considerably overstating what the short passage at col.3 lines 62-64 of Fette teaches. In claim 1 an attempt is made to use a first beam to provide a direct communication link with a terminal and, failing that, a second beam is used to provide a first 'hop' of a multi-path link with the terminal, with the first hop extending between the base station and a relay equipment. Fette fails to teach the use of the "diverse beams" in this manner. One of ordinary skill is given no instruction whatsoever of how to use the "diverse beams".

Furthermore, in claim 1 each beam has "an amount of resources for supporting communication links with terminals located in the beams". The direct link via the first beam uses the resources of the first beam while the link between the base station and the relay equipment uses the resources of the second beam. Fette fails to teach this further limitation of claim 1. Indeed, the term "spatial diversity" is normally understood to mean beams which are diverse in terms of space (direction) but which otherwise use the same resources (e.g. frequency bearers, time slots on a bearer). This is the opposite to what is required by claim 1, where the first and second beams each have an amount of resources. It is this use of the resources of different beams which achieves the load balancing effect of the present invention.

In view of the above, the Examiner's first ground of rejection for anticipation is clearly in error.

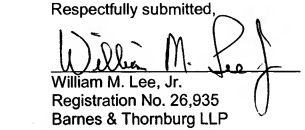
Ground (2)

As all of the Examiner's obviousness rejections are also based on this incorrect interpretation of Fette, the obviousness rejections fall away for the same reasons.

Reversal of the Examiner's rejections is therefore respectfully requested.

November 8, 2006

Respectfully submitted,



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Claims Appendix

1. A control entity for a wireless communications system which comprises a plurality of base stations, each base station defining a plurality of beams which each have an amount of resources for supporting communication links with terminals located in the beams, and a relaying equipment, wherein the control entity is arranged to determine if a direct communication link can be supported between a new terminal and a base station using a first beam and, if the direct communication link cannot be supported, to invoke use of the relaying equipment to provide a first communication link between a base station and the relaying equipment using the resources of a second beam and a second communication link between the relaying equipment and the terminal whereby to provide a multi-hop path between the base station and the terminal.

2. A control entity according to claim 1 wherein the first beam and the second beam are defined by the same base station.

3. A control entity according to claim 2 wherein the first beam and the second beam are separated by at least one intermediate beam of the base station.

4. A control entity according to claim 1 wherein the base station defines a plurality of sectors and the beams have a width which is narrower than the width of the sectors.

5. A control entity according to claim 1 which is arranged to adapt the shape of the second beam to serve the relaying equipment.

6. A control entity according to claim 1 which is arranged to determine if the first beam has sufficient resources to support a direct communication link with the new terminal.

7. A control entity according to claim 6 which is arranged to determine if the first beam has sufficient resources to support a direct communication link without reducing quality of communication for existing terminals served by the first beam below a predetermined limit.

8. A control entity according to claim 7 which is arranged to determine an amount of resources required to support the direct communication link between the new terminal and the base station, to determine a reduced amount of resources available to existing terminals served by the first beam if the base station were to accept the new terminal, and a quality of communication resulting from the reduced amount of resources.

9. A control entity according to claim 7 wherein the base station uses equal throughput scheduling (EQT).

10. A control entity according to claim 1 wherein there are a plurality of relaying equipments positioned within the beams and the control entity is further arranged to select a relaying equipment, from a plurality of candidate relaying equipments, to provide the multi-hop path.

11. A control entity according to claim 10 wherein the control entity is arranged to select a relaying equipment on the basis of the quality of the first communication link that the relaying equipment can provide.

12. A control entity according to claim 10 wherein the control entity is arranged to select a relaying equipment on the basis of the quality of the second communication link that the relaying equipment can provide.

13. A control entity according to claim 10 wherein the control entity is arranged to select a relaying equipment on the basis of distance between the relaying equipment and the new terminal.

14. A control entity according to claim 10 wherein the control entity selects a relaying equipment in order to compensate for the shape of the beams.

15. A control entity according to claim 1 wherein the second communication link uses the resources of the first beam.

16. A control entity according to claim 1 wherein the second communication link uses the resources of the second beam.

17. A control entity according to claim 1 wherein the second communication link uses resources which are separate from those allocated to each beam for direct communication with terminals.

18. A control entity according to claim 1 which is part of the base station or a base station controller.

19. A control entity according to claim 1 which is part of the terminals or relaying equipment.

20. A base station for a wireless communications system including a control entity according to claim 1.

21. A base station controller for a wireless communications system including a control entity according to claim 1.

22. A terminal for a wireless communications system including a control entity according to claim 1.

23. A method of establishing a connection between a new terminal and a base station in a wireless communications system, the system comprising a plurality of base stations, each base station defining a plurality of beams which each have an amount of resources for supporting communication links with terminals located in the beams, and a relaying equipment, the method comprising:

determining if a direct communication link can be supported between the new terminal and the base station using a first beam;

if the direct communication link cannot be supported, invoking use of the relaying equipment to provide a first communication link between a base station and the relaying equipment using the resources of a second beam and a second communication link between the relaying equipment and the terminal whereby to provide a multi-hop path between the base station and the terminal.

24. A method according to claim 23 wherein the first beam and the second beam are defined by the same base station.

25. A method according to claim 24 wherein the first beam and the second beam are separated by at least one intermediate beam of the base station.

26. A method according to claim 23 further comprising adapting the shape of the second beam to serve the relaying equipment.

27. A method according to claim 23 further comprising determining if the first beam has sufficient resources to support a direct communication link with the new terminal.

28. A method according to claim 27 further comprising determining if the first beam has sufficient resources to support a direct communication link without reducing quality of communication for existing terminals served by the first beam below a predetermined limit.

29. A method according to claim 28 further comprising:

determining an amount of resources required to support the direct communication link between the new terminal and the base station;

determining a reduced amount of resources available to existing terminals served by the first beam if the base station were to accept the new terminal; and

determining a quality of communication resulting from the reduced amount of resources.

30. A method according to claim 27 wherein the base station uses equal throughput scheduling (EQT).

31. A method according to claim 23 wherein there are a plurality of relaying equipments positioned within the beams, the method further comprising selecting a relaying equipment, from a plurality of candidate relaying equipments, to provide the multi-hop path.

32. A method according to claim 31 wherein the selecting step selects a relaying equipment on the basis of the quality of the first communication link that the relaying equipment can provide.

33. A method according to claim 31 wherein the selecting step selects a relaying equipment on the basis of the quality of the second communication link that the relaying equipment can provide.

34. A method according to claim 31 wherein the selecting step selects a relaying equipment on the basis of distance between the relaying equipment and the new terminal.

35. A method according to claim 31 wherein the selecting step selects a relaying equipment in order to compensate for the shape of the beams.

36. A method according to claim 23 wherein the second communication link uses the resources of the first beam.

37. A method according to claim 23 wherein the second communication link uses the resources of the second beam.

38. A method according to claim 23 wherein the second communication link uses resources which are separate from those allocated to each beam for direct communication with terminals.

39. A computer program product for use in a wireless communications system comprising a plurality of base stations, each base station defining a plurality of beams which each have an amount of resources for supporting communication links with terminals located in the beams, and a relaying equipment; the computer program product comprising a machine readable medium carrying instructions for causing a control entity to perform the steps of:

determining if a direct communication link can be supported between a new terminal and a base station using a first beam;

if the direct communication link cannot be supported, invoking use of the relaying equipment to provide a first communication link between a base station and the relaying equipment using the resources of a second beam and a second communication link between the relaying equipment and the terminal whereby to provide a multi-hop path between the base station and the terminal.

40. A control entity for a wireless communications system which comprises a plurality of base stations, each base station defining a plurality of beams which each have an amount of resources for supporting communication links with terminals located in the beams, and a relaying equipment, the control entity comprising:

means for determining if a direct communication link can be supported between a new terminal and a base station using a first beam;

means for invoking, if the direct communication link cannot be supported, use of the relaying equipment to provide a first communication link between a base station and the relaying equipment using the resources of a second beam and a second communication link between the relaying equipment and the terminal whereby to provide a multi-hop path between the base station and the terminal.

Related Proceedings Appendix

There is no such appendix.

Evidence Appendix

There are no such appendices.